Remarks

Claims 1-11 remain pending in this application after entry of this paper. Original claims 6-10 have been indicated as containing allowable subject matter. Claims 1-5 have been rejected. The Examiner did not comment on claim 11. Applicants have amended claims 6-11 to put them in independent form, and allowance of these claims is respectfully requested.

Applicants have reviewed the Office Action, the invention is believed to be patentable, and claims 1-5 are also believed to recite patentable subject matter.

The invention relates to fluorescent lamp electronic ballasts and to power factor correction for fluorescent lamp electronic ballasts. Applicants had recognized that conventional ballasts that use a hold-up capacitor or passive power factor correction (PFC) L-C filters on the input are not able to operate with a varying frequency. At higher frequencies, these conventional ballasts draw excessive current, exhibit poor power factor, and exhibit poor total harmonic distortion (THD). PFC boost converters have been used in ballasts, but the converter topology creates in-rush current at turn-on.

The invention involves an improved fluorescent lamp electronic ballast that includes a power factor correction flyback circuit and an inverter ballast circuit. The invention further involves a number of detailed aspects usable in various combinations.

Claims 1-5 stand rejected under 35 U.S.C. § 102(e) as anticipated by Che-Chen (U.S. Patent No. 6,703,796). Che-Chen describes a power supply that integrates a rectifier/filter's circuitry and a converter's circuitry with an inverter to reduce space occupied and increase power efficiency. The power supply includes a rectifier/filter, a DC-DC converter, and a DC-AC inverter. The rectifier/filter, connected to an alternating current (AC) input terminal, converts the input AC into a direct current (DC). The DC-DC converter and the DC-AC inverter are parallel to each other with one end concurrently connected to the

rectifier/filter's output and the other end respectively outputting the desired powers. As such, the DC-DC converter reduces the converted DC voltage to lower DC voltages to power all circuits except for the lamp, and the DC-AC inverter inverts the converted DC voltage into higher AC voltage output to drive the lamp.

Che-Chen illustrates the power supply and inverter in Figures 2-8. Figure 1 of Che-Chen illustrates a typical power supply, and the Figure is labeled as "Prior Art."

Figure 1 and the background section of Che-Chen describe a typical power supply system including an AC source input from a socket passing through a rectifier/filter 11, a flyback converter 12, a DC-AC inverter 13, and a buck regulator 14 to provide the lamp with AC power and other elements of the display system with DC power. According to Che-Chen, the typical power supply system must convert between AC and DC in too many stages, which causes inconvenience and inefficiency. In current products, the rectifier/filter 11 and the flyback converter 12 are combined together to form an additional adapter 10, which is further connected to the inverter 13 and the buck regulator 14 via additional connectors and cables. According to Che-Chen, such a product carries power efficiency only to about 70%, high production costs, and larger dimensions.

In contrast to this part of Che-Chen, Applicants' invention contemplates a power factor correction flyback circuit and inverter ballast circuit. The power factor correction flyback circuit provides power factor correction and overcomes problems specifically noted by Che-Chen. This part of Che-Chen makes no suggestion of the claimed combination including the power factor correction flyback circuit, but only discusses a typical power supply and its problems.

The remainder of Che-Chen describes the Che-Chen invention. More specifically, Che-Chen contemplates a power supply system including an impedance adjustment circuit (34) in the DC-AC inverter (23). In detail, Che-Chen explains adjusting impedance in the DC-AC inverter to handle larger voltages without excessive increases in frequency.

In contrast to this remaining part of Che-Chen, Applicants' invention contemplates a power factor correction flyback circuit and inverter ballast circuit. This remaining part of Che-Chen makes no suggestion of the claimed combination including the power factor correction flyback circuit, but only describes an impedance adjustment circuit (34) and a DC-AC inverter (23). These aspects of Che-Chen are unrelated to the invention.

As explained above, the different power supplies discussed by Che-Chen fail to suggest the invention. Claim 1 specifically recites a combination of features including a power factor correction flyback circuit and an inverter ballast circuit, and is believed to be patentable for reasons given above.

Claims 2-5 recite additional detailed aspects of the invention, and are each believed to be separately patentable.

In the detailed Action, the Examiner makes a number of comments regarding claims 1-5, which are now addressed. In rejecting claim 1, the Examiner makes simultaneous reference to both the Figure 1 and the Figure 2 power supplies of Che-Chen. There is no suggestion that these two power supplies may be combined, let alone any suggestion to combine them to achieve the claimed invention. After all, the Che-Chen patent teaches away from the Figure 1 arrangement. As for the Figure 2 arrangement, this power supply does not appear to include any flyback arrangement, and instead connects rectifier/filter 21 directly to DC-DC converter 22 and DC-AC inverter 23 in parallel. Again, claim 1 is believed to be patentable.

In rejecting claims 2-5, the Examiner also makes simultaneous reference to both the Figure 1 and Figure 2 power supplies of Che-Chen. Again, there is no suggestion that these two power supplies may be combined, let alone any suggestion to combine them to achieve the claimed invention.

Regarding claim 2, this claim recites the rectifier receiving an AC input having a varying frequency and the rectifier having a sufficiently low input capacitance such that the rectifier output substantially takes the form of a rectified AC wave. The Examiner refers to Figure 1 and column 2, lines 45-67 of Che-Chen. There is no suggestion of the claimed feature. Figure 1 only shows a typical power supply and makes no mention of an approach involving low input capacitance as claimed. Further, column 2, lines 45-67 only describe the direct connection of the DC-DC converter 22 and DC-AC inverter 23 in parallel to the rectifier/filter's output.

Regarding claim 3, this claim recites the flyback converter being configure to operate in a transition mode. That is, the switching frequency of the flyback transformer varies in response to the instantaneous line voltage and output current. Operation in transition mode is advantageous in that it results in reduced EMI when compared to a PFC circuit that has a fixed switching frequency. The Examiner refers to Figure 1 of Che-Chen, but Figure 1 of Che-Chen fails to suggest this claimed feature. Figure 1 of Che-Chen does illustrate a flyback converter 12, but there is no discussion of transition mode operation as in the claimed combination.

Regarding claim 4, this claim recites that the flyback converter includes a control loop configured to monitor the flyback transformer and switch the flyback transformer asynchronously as needed to maintain energy balance. The Examiner generally refers to Figures 1-5 of Che-Chen. The Examiner has not pointed out any specific teaching of asynchronous switching of a flyback transformer to maintain energy balance in an electronic ballast. The power supplies in Che-Chen fail to suggest this claimed feature.

Regarding claim 5, claim 5 recites that the control loop (from claim 4) is connected to the DC output (of the flyback circuit). The Examiner only refers generally to Figures 1-5 of Che-Chen. Again, Che-Chen fails to suggest this closed loop aspect of the invention as recited by claim 4, and further fails to suggest the specific connection recited by claim 5.